1979

State Park Guide 7

GEOLOGIC STORY OF SPRING MILL STATE PARK

STATE OF INDIANA
DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY
611 NORTH WALNUT GROVE AVENUE-BLOOMINGTON, INDIANA 47401

PRICE 10¢

INTRODUCTION

Spring Mill State Park's historic impact ranging from the pioneer village to the space-age Grissom Memorial is matched by Indiana's heritage of nature that the park preserves. Caves, sinkholes, and many other features display classic geology, which, when fully understood, adds a new dimension of enjoyment to a park visit. How can caves be hollowed from seemingly solid rock? Why is so much of the surface of the park pockmarked by basinlike depressions?

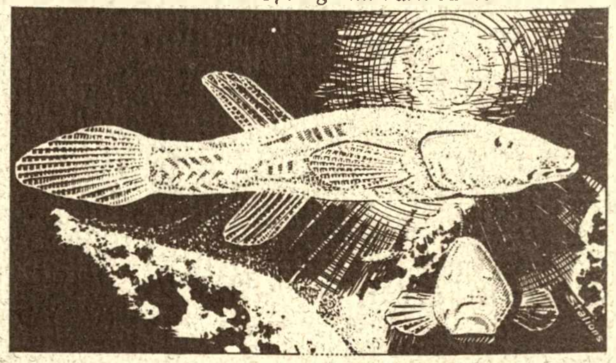
The landforms of the park depend on two things: the kind of rock and such forces as running water and ground water (water in openings in the rock beneath the surface) that sculpture the rock. The layers of rock in the park were formed more than 300 million years ago during the geologic time interval known as the Mississippian Period. But weathering, mass wasting, and erosion by water, which still break down and move rock debris, have formed the present land surface within only the past few million years.

BEDROCK

The composition of the oldest rock in the park, the Salem Limestone, tells us that the deposits we now see as ledges of limestone exposed in various areas of the park accumulated at the bottom of the sea, for the Salem is made up dominantly of nearly sand-size fossils of sea-dwelling animals.

The Salem is world famous as a building stone. The park inn, the Empire State Building, and Indiana's state capitol are just a few examples of its use. In some places the upper part of this rock formation in particular is

Blind fish of Spring Mill Park caves



finer grained and less pure than the building stone. The entrances to Hamer and Donaldson Caves are in this less pure phase of the Salem. The Salem is being quarried for cement just a few miles from the park, and a small abandoned quarry is on the west bluff of Mill Creek between the dam and the park boundary near the limekilns used in the late 1800's for making cement.

Overlying the Salem Limestone is a sequence of thinner bedded and less pure limestones that include some thin layers of shale and dolomite. These rocks are part of the St. Louis Limestone and indicate a change in conditions following deposition of the Salem. The thick deposits of gypsum mined from the St. Louis east of Shoals, Ind., indicate high concentrations of minerals in the sea, and this probably accounts for the scarcity of fossils in part of the formation. The higher and larger parts of the cave systems in Spring Mill Park are in the St. Louis Limestone, and the old gristmill is built of blocks of this rock. The formation is unusually well exposed above the entrance to Hamer Cave.

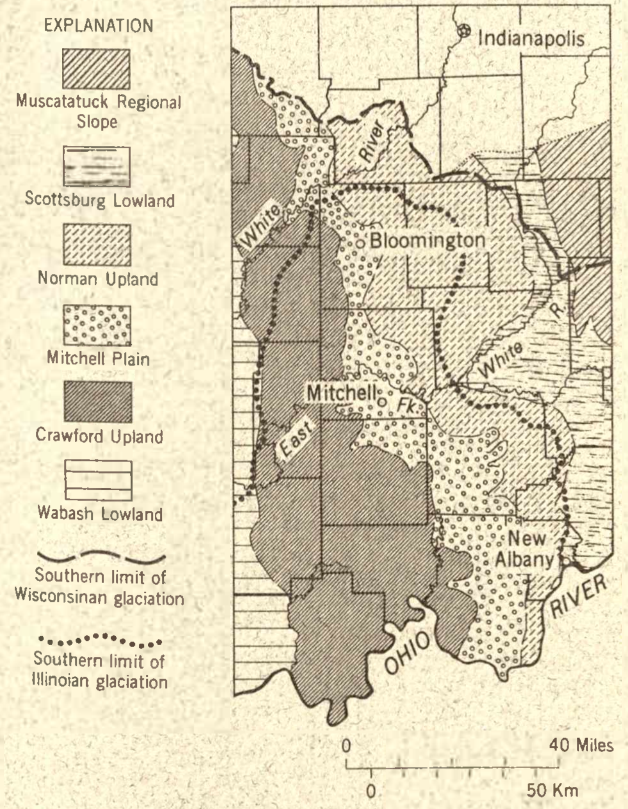
After many more hundreds of feet of sediment accumulated on top of the St. Louis Limestone, the area was uplifted, its rocks were tilted slightly toward the southwest, and erosion set in. During episodes of movement, intersecting systems of fractures called joints were formed in the rock, and they have exercised much control in the position of caves and sinkholes.

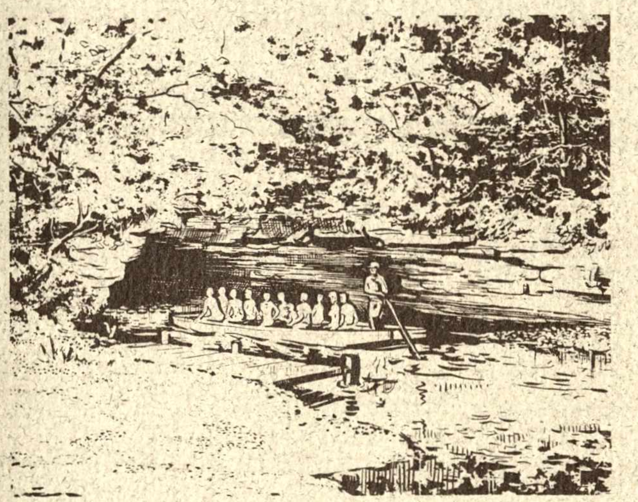
THE MITCHELL PLAIN, SINKHOLES, AND CAVES

Erosion gradually removed much of the rock overlying the Mississippian limestones and reduced much of Indiana to a nearly flat low-lying surface. Only a few million years ago still more uplift gave added energy for erosion that stripped away great masses of rock down to the thick limestone sequence that now forms a rolling upland karst surface. Karst is topography characterized by a profusion of depressions called sinkholes and by other features that result from dissolving or solution of the bedrock, so that much of the surface drainage then goes underground through sinkholes into cavern passages. Spring Mill is centrally located in, and is typical of, the karst region that is named the Mitchell Plain because of its excellent development in the Mitchell area. The extent of this feature in Indiana is shown on the physiographic diagram.

Rainwater, which is slightly acidic, sinks into the ground. It follows cracks and other openings in the rocks and tends to flow most rapidly along intersections of joints where the most solution of rock takes place. Ultimately, an open network is formed in the rock as the solvent action enlarges the openings. As the vertical openings enlarge below the surface, the overlying mantle and soil under the influence of gravity gradually creep toward the openings to be carried away. A depression formed by this process is termed a sinkhole. Almost all sinkholes in the park are in the St. Louis Limestone. Some parts of caves are also vertical, although many caves result from dissolving of more nearly level passages. Caves may also be enlarged by collapse of rock from the ceiling.

The sinkholes on the Mitchell Plain number more than 100 per square mile in parts of the park and reach a known maximum of 1,023 in a square mile near Mitchell. Some of the water that goes into the sinkholes and underground later emerges in springs like those near the camping area. (See map.) In a karst area spring water commonly flows as a surface stream for only a short distance before again disappearing underground in a special kind of sinkhole called a swallow hole. This is true of water from two of the springs shown on the map.



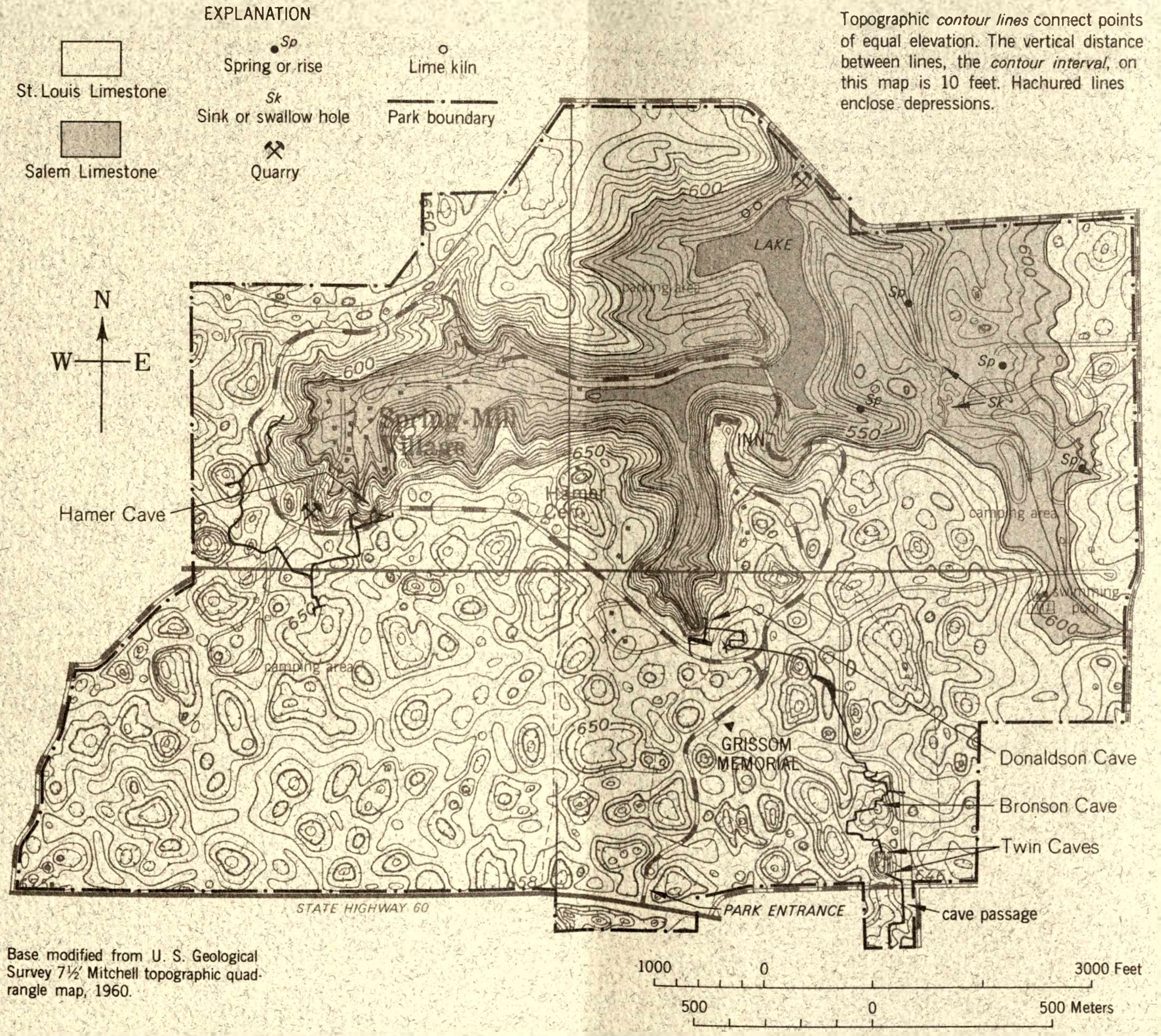


Upper Twin Cave and boat excursion

DONALDSON CAVE SYSTEM AND HAMER CAVE

Of the named caves in the park, Donaldson Cave, along with its upstream segmented parts, and Hamer Cave are the two major caves. It is even possible that they once were parts of a single system. That is, both emerge in steep-walled valleys that, at least near the caves, were obviously formed by the collapse and dissolving of the cave roof. Some geologists believe that this collapse started below the junction of Hamer and Donaldson Branches of Mill Creek and that as the cave collapse worked farther and farther back, weathering and surface erosion further widened and smoothed out the valleys where the lake and Spring Mill village are located.

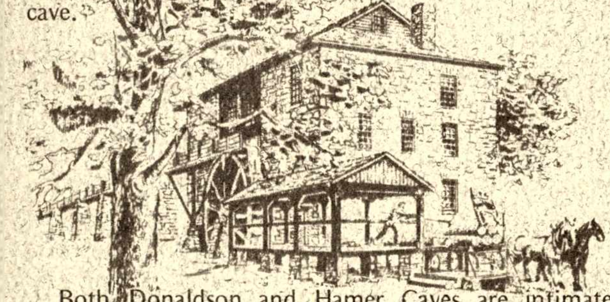
Solution enlargement and collapse have occurred not only at the mouths of the caves but also for the Donaldson Cave system at two points upstream, perhaps where sinkholes were directly above the cave, thereby exposing the cave stream to view and forming new entrances to the cave. These collapse areas, Bronson



TOPOGRAPHIC MAP OF SPRING MILL STATE PARK, LAWRENCE COUNTY, INDIANA

Cave and Twin Caves, are called karst windows, a term derived from the Twin Caves as the primary example. The map shows how these features fit along the single cave stream that makes its final exit from a stygian world at the mouth of Donaldson Cave.

A boat ride in Upper Twin Cave provides convincing evidence of how wet caves can be. It also shows that not all caves are profusely ornamented by stalactites, stalagmites, and other cave deposits. Even to a geologist, one of the most fascinating things about this trip is seeing the blind, nearly white fish that have adapted to a life in total darkness. At the turn of the century they were studied in Donaldson Cave by Prof. Carl Eigenmann of Indiana University. His holding basins can still be seen inside and a short distance in front of the cave.



Both Donaldson and Hamer Caves are intimately related to the history of the park, and indeed the Indians left a record of their presence at Donaldson, which earlier was named Shawnee Cave. Both caves served as a source of water to power mills, and even today the aqueduct from Hamer Cave provides water for the restored mill in the village. A flume from the mouth of Donaldson Cave fed Isaac Fife's gristmill, which was later run as a sawmill and wool-carding mill by James C. Lynn. Some saltpeter was taken from the caves, mostly from Donaldson, for manufacturing gunpowder, and villagers butchered meat and also cooled perishable food in the caves. Thus, history and geology merge in Spring Mill State Park.

Carl B. Rexroad, Paleontologist
Lois Mittino Gray, Park Naturalist

Park caves except for the two dry side passages of Donaldson Cave are not to be explored without a park guide.

Cover Art — Entrance to Donaldson Cave

State Parks (In

Spring Mill State Park's Caves

By Richard D. Philpott
Manager, Spring Mill State Park

Spring Mill State Park, established in 1927 and comprised of 1,319 acres in Southwestern Indiana's Lawrence County, is one of the most versatile of the numerous outdoor recreation facilities operated by the Indiana Department of Natural Resources.

Probably best known of the Park's attractions is the restored Pioneer Village, which includes the water-powered Grist Mill and Saw Mill that were the nucleus of the community. These mills are operative, and because they are among the few such authentic mills remaining they attract thousands of visitors each year.

The Pioneer Village also includes several authentic log cabins, some of them moved from locations nearby, and such community structures as the Post Office, Tavern, Distillery, Apothecary, General Store, Candle Shop, Weaving Shop, Leathercraft Shop, and an Art Gallery.

During the Summer craftsmen demonstrate how desired products were hand-made when the Village was at its zenith in the mid-1800s. However, Spring Mill, like all Indiana State Parks, is open the year-around, as is the Spring Mill Inn, which offers food and overnight accomodations. [See *Outdoor Indiana*, August, 1967; April, 1970; December, 1971.]

Many other visitors are attracted to Spring Mill State Park by the large stand of virgin woods, one of the few such hardwood forests remaining intact in Indiana. Other activities are camping, hiking, picknicking, horseback riding, boating, fishing, swimming, and guided Nature study tours.

And since 1971 many others, particularly young people, have come to Spring Mill State Park to see the Virgil I. Grissom State Memorial. This small but comprehensive museum includes many items and data regarding the pioneering American Astronaut, who grew up in Mitchell, the community immediately West of the Park. [See *Outdoor Indiana*, November, 1971.]

State government interest in the Spring Mill community began before the turn of the 20th Century when scientific explorations were made of the neighborhood's system of caves. This article is intended to explain briefly the different caverns as they are known today.

DONALDSON CAVE

Donaldson Cave (also known as Shawnee Cave) offers exceptional picturesque beauty. It is located in a gorge where a stream emanates from the cavern floors. There are three passages in the mouth of the Cave, two of which must be reached by stairways.

The passage on the right is about 10 feet high and 15 feet wide and ends approximately 200 feet later. The left-hand passage even shorter. The middle (main) passage consists of a stream which is very narrow, with a waterfall approximately 100 feet from the entrance. In order to reach this particular point it is necessary to have a specially built boat due to the Cave's narrowness.

Donaldson Cave is connected by Bronson and Twin Caves. During the Summer months a short boat trip and a Park Guide's lecture are available for a fee of 25¢ per person. The Cave's hidden beauty, which can only be seen by this excursion, reveals the history of the formation.

TWIN CAVES

This cave, part of the Donaldson Cave system, is also known as Upper and Lower Twin Caves. The Upper Cave is the beginning of our Cave system at Spring Mill State Park, while the Lower Cave connects with Bronson Cave.

Upper Twin Cave has been explored by boat for a distance of approximately 5,000 feet. After this point is reached the cavern becomes smaller and a boat can no longer be used. However, the stream flows the entire length of the Cave. During the Summer months Park Guides provide boat rides and lectures at this cave for a fee of 50c per person.

These caves were formed by the action of ground water dissolving the limestone bedrock. It was in a pool at this site that Dr. Carl H. Eigennmann, of Indiana University, made his famous discovery of the blind Cave Fish, naming them *Amblyopsis,* or "Dim eyed", because these fish have no eyes and are entirely white.

Twin Caves also are known for their stalactites and stalagmites, formed by drops of water over a period of thousands of years.

BRONSON CAVE

This cave is part of Donaldson's Cave system. The Cave has two entrances, both in the bottom of a Karst window. The entrance to the North opens into passageways which exits at Donaldson Cave. The entrance is the stream outlet for water which flows from Twin Caves. The main passage of Bronson Cave is low and narrow and breakdown partly covers the floor.

HAMER CAVE

The water from this Cave is used to power both the Grist Mill and the Saw Mill, located in Spring Mill Pioneer Village. The Cave entrance is dammed and the long wooden flume carrying water to the Mill has been reconstructed. One can wade the stream which flows from the Cave through the Village.

About 1,200 feet from the entrance of the cave, a drier upper passage leads to the West. This upper level is about five feet wide and

Yellowood State Forest, Between Brown County S.P. and Morgan-Monroe S.F., Also Offers Unsurpassed Autumn Color.

October 1974 Outdoor Indiana

10 feet high and is crossed several times by small streams.

Lehigh Portland Cement Company contributed land to Spring Mill Village when the State acquired it 47 years ago and the agreement was made that the industry was to have access to the water from Hamer Cave. A reservoir near the entrance of the Cave was built by Lehigh for this utilization.

The Entrance to Donaldson's Cave.

Cave exploration (spelunking) is not permitted at Spring Mill without a Park Guide in attendance. This is for the visitors' safety. The Caves are totally dark and dangerous.

The Indiana Department of Natural Resources also operates the Wyandotte Caves at Wyandotte

Spring Mill State Park Guides Must Accompany All Cave Visitors.

The Rugged Terrain Around the Spring Mill Caves Has Virgin Stands of Indiana Hardwoods.

Under Department of Natural Resources Management, Southern Indiana's Caverns Are Becoming World Famous. Here Is Little Wyandotte Cave, at Harrison-Crawford State Forest. There Are Also Guided Tours at Nearby Big Wyandotte Cave.

Woods, farther to the South. Guided tours likewise are available there the year around. Big Wyandotte and Little Wyandotte Caves are also part of the Southern Indiana system of caverns which are especially interested to geology students. [See *Outdoor Indiana*, September, 1967; July, 1969; September, 1974.]

These Indiana Caves were sources of essential water power for Hoosier pioneers. By acquiring large tracts surrounding them, the Department of Natural Resources is preserving for posterity typical primitive landscapes of scenic grandeur and rugged beauty.

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Demonstrations at Spring Mill Pioneer Village

The Ancient Art of Dyeing

By Lois Mittino, Naturalist, Spring Mill State Park

A visit to the pioneer village in Spring Mill State Park in Southwestern Indiana's Lawrence County is a trip into Time. A stroll through the Village offers a Park visitor the opportunity to understand and imagine the daily chores which were so much a part of our early Hoosier settlers way of life.

The Spring Mill Village Weaver Shop recalls the arduous tasks of sheepshearing, wool carding, spinning, and weaving to get a desired article of clothing. However, one step in the clothing process is usually forgotten by most Park visitors until they see me in one of the log cabins, fussing over my simmering pots or hanging wet yarns out to dry.

Color! What today we find so commonplace was to our ancestors something which required hours of work. If a pioneer woman wanted her clothes to be a color other than "lamb's wool gray" she had to go in search of a native plant rich in subtle hues and shades.

Dyeing with natural materials is an ancient art, dating as far back as 3,000 B.C. to the early Egyptians. The Greek and Roman cultures refined the processes. Gradually through the years the process of dyeing was built into a small industry.

This Authentic Apothecary Shop Is One of the Numerous Craft Structures at Spring Mill State Park's Pioneer Village.

The Europeans had many recipes, accumulated from extensive trade in foreign lands. Early settlers in North America brought with them one or two of their favorite dye plants and recipes from the Continent. But most of the pioneers were forced by isolation to experiment with the vast array of plant life which they found in the New World.

The American Indians supplied helpful hints to the settlers, as they

A DYE COLOR WHEEL (Reading Clockwise)—(1) Solid White—Starting Color. (2) Pink—Made with a Lichen Dye. (3) Tan—Sumac Berries with Alum. (4) Tan—Sumac Berries, no Mordant. (5) Gray—Sumac Berries, Copperas.

(6) Goldenrod—No Mordant; Pale Yellow. (7) Goldenrod—Copperas; Dark Green. (8) Goldenrod—Alum; Brighter Yellow. (9) Goldenrod—Copper Sulfate; Olive Green-Yellow.

(10) Pokeberry—Alum; Bright Pink; Fuschia. (11) Pokeberry—No Mordant; Light Pink. (12 Bloodroot—Copperas; Dull Tan. (13) Bloodroot—No Mordant; Bright Orange. (14) Bloodroot—Alum; Light Orange. (15) Elderberry—Less Boiling Time; Lilac. (16) Elderberry—More Berries Used; Deep Purple. (17) Elderberry—More Boiling Time; Burgundy.

(18) Shagbark Hickory Bark—Plain; Light Yellow. (19) Sycamore Bark—Plain; Dark Beige. (20) Sycamore Bark—Plain—Less Time; Beige. (21) Osage Orange Bark—Medium Orange. (22) Black Walnut—Plain; Dark Brown. (23) Black Walnut—Alum; Medium Brown. (24) Onion Skins—Copper Sulfate—Drab Green. (25) Onion Skins—Alum; Bright Yellow. (26) Carrot Tops—Beige.

Outdoor Indiana - April 1976

were fond of using the inner and outer barks of trees for color. The natives often set these dyes with urine and the ashes of Cedar wood.

As the pioneer villages grew, skilled dyers would offer their services for a fee. It is interesting to note that such an operation served Spring Mill villagers when James C. Lynn built a wool carding mill in the 1840s, using the creek waters issuing from Donaldson Cave as a power source.

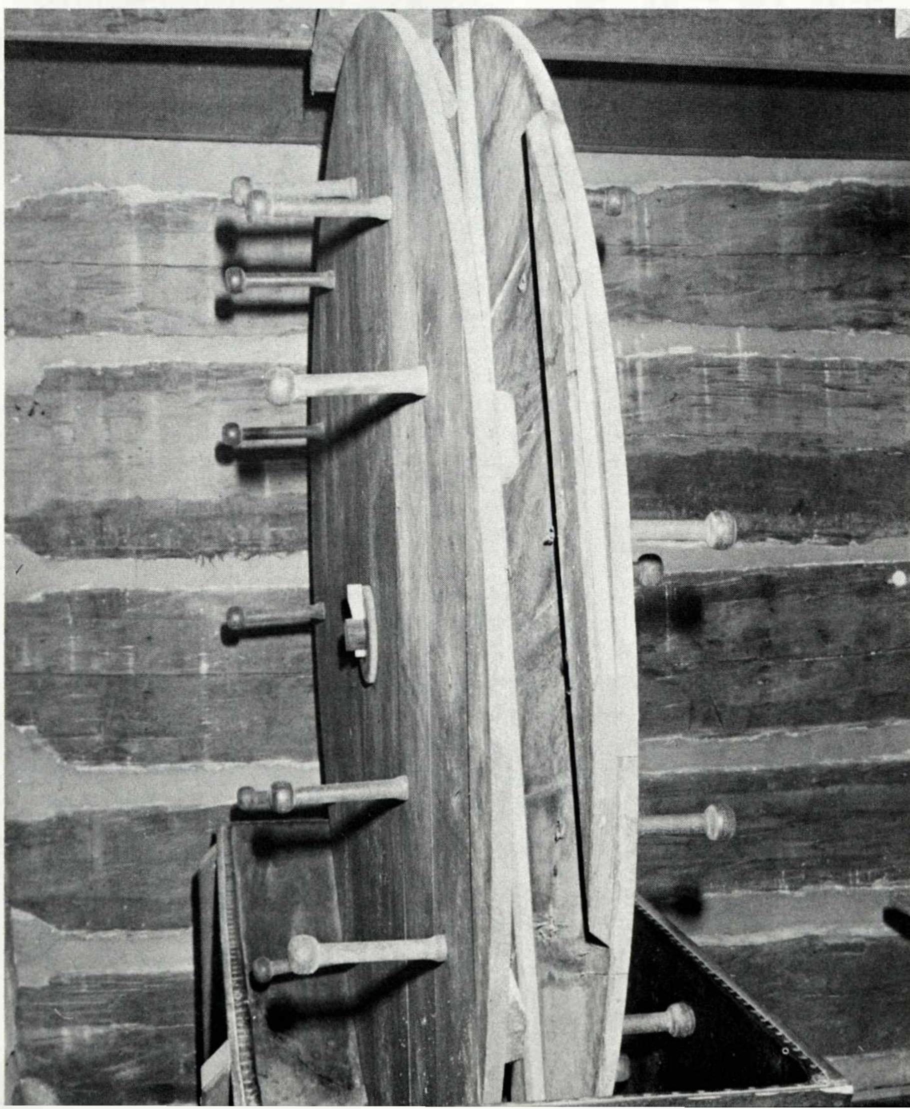
Natural dyes were used universally until the late 1800s, when chemical or aniline dyes were first mass produced. Individual dyers were edged out of business and the craftsmanship of the dyer's art was lost. Today there is a revived interest in natural plant dyes, for they have a beauty of their own which creates variations within a color that seem to belong solely to Nature herself.

Pioneer women certainly must have used trial-and-error methods to discover which plants gave readily their richest shades. Even today one never knows exactly what shade a dyed object will take on. Advocates of natural dyes believe this variability is the greatest challenge of the ancient art.

A person planning to make something with these yarns should dye the full amount needed all at the same time to have a matched dye lot.

Factors which can affect the shade of the dye are many in number. The length of time a plant part is boiled directly affects the intensity of the shade. To extract color, the plant must be boiled vigorously to produce a "dye bath". An average boiling time is one hour but roots and barks generally take longer. Heat is then removed and the plant material is taken out with a strainer.

This Wheel in the Hatmaker's Shop Was Used to Dip the Hats, Hung on the Pegs, Down into the Dye Vat.



Also, the amount of plant material used alters shade, and this is left to the whim of the experimenter. For instance, the three different shades of Elderberry on the color wheel pictured on Page 22 are the result of varying boiling times and berry amounts.

The greatest color variable is of course the plant selected for dye, and the part of that plant which will be boiled for color. Root colors are usually stronger and brighter than other juice-containing parts of the plant.

Bloodroot, Sassafras, and Dock are common root dyes. Berry colors are bright and cheery but they tend to wash out rapidly and are not colorfast in the Sun. Pokeberry makes a beautiful color but it is vulnerable to the elements, as are Elderberries and Juniper berries.

Nut hulls, such as Black Walnut and Pecan, are interesting ingredients for dye experiments. However, remember Black Walnuts not only dye cloth but also your hands! Walnut is the most colorfast of the natural dyes.

Leaves of the Rhododendron, Lily of the Valley, Tuliptree, and fermented Peach leaves yield fine color results.

Tree barks offer delicate shades. Birch, White Oak, Butternut, Maple, and Sycamore were used by the early Indiana settlers.

Garden flowers such as Marigolds, Zinnias, and Dahlias give sunny shades, along with the wild Goldenrod. Even Poison Ivy can be used (carefully) to get a blackish tone!

Lichens such as *Umbilicaria* and Orchil are commonly used dyes. Many dyestuffs can actually come right from your garbage. These include Onion skins, Coffee grounds, Carrot tops, Purple Cabbage, and Concord Grape skins.

The season in which a plant is picked also can affect the color result. Plant parts have a different concentration of juices at certain times. For example, it is best to pick tree barks in Spring and it is recommended to use Goldenrod right before the flower head blossoms open.

Most plant parts can be dried for later use but the shade will be different from fresh dyes. Even the soil, sunlight, and general growing condition can affect the color from each plant. A dyer cannot be assured that a Pokeberry growing in a dry field will produce the same hue as one growing in moist partial shade near a garage.

Probably the greatest factor influencing the end result of your color is the type of *mordant* being used. Mordant is derived from the Latin word *mordere,* meaning "to bite," as it causes the color to bite into the fabric. Actually mordants are chemicals which cause the fabric to accept chemically a dye color it might not have normally in the reaction.

All except a few dye plants require a mordant to fix the color. In most cases it improves the shade.

Pioneer mothers did not understand the sophisticated chemistry behind binding molecules and color acceptance. But through experience they knew the worth of chemical additives to "set" the dye. Household items such as soda, salt, lye from dripping ashes, and vinegar was thrown into the dyepot. A "bluepot" was kept near the hearth to collect urine for the dyebath. This was usually referred to as *chamberlye.*

Copperas is a very common mordant used today and can be purchased at any drug store. It was available in the last Century to villagers at the Spring Mill apothecary shop. Copperas is a type of iron compound. It is referred to as a *"saddening agent"* as it dulls and darkens any dye bath when a teaspoon is added to the water. The heavy cast iron pots used by early Indiana settlers acted chemically in the same manner to influence the color. For this reason, pioneers often had drab and dull clothes. Rusty nails and the filings from the blacksmith forge added to the dullness when they were thrown into the dyepot.

To illustrate the effect of iron in the dye reaction, the pictured color wheel shows that Sumac berries produce a tan color when boiled but turn the yarn to dull gray when copperas is added.

Spring Mill State Park's Naturalist Mixes Up a Dye Batch Inside the Apothecary Shop.

How could the pioneers brighten their colors? Copper pots achieve brighter colors along with copper sulfate (blue vitriol), which adds nice tones to blues and greens. Tin and chrome are brightening mordants. But the most common brightener today is alum in combination with cream of tartar. Again, this would have been available at the original Spring Mill apothecary shop.

These chemical mordants can be added directly to the dyebath. The most common method is to let the wool simmer for an hour in the chemical mixed with water before placing the wool in the dyebath.

The actual process of dyeing occurs after the mordanted wool is placed in the newly-made dyebath. The wool should be washed beforehand in a very mild detergent. Wool is the best fabric to use, as the protein in this animal fiber accepts the dye color better than the cellulose in plant fiber.

The wool should be simmered in the dye color for approximately one hour. Never boil the wool in the dye as wool does not work up well when temperature-shocked.

The wool should be rinsed several times after removal from the pot, in progressively cooler waters. The final step is to hang the yarns up to dry away from a sunny area.

Pioneers utilized many native plants but others were imported and sold in the apothecary shop. The most famous imported dye was indigo. It might be noticed on the color wheel that there is no good blue represented which can be made from a native plant. Indigo was often grown in the pioneer garden for its treasured shades of blue.

Madder, fustic chips, saffron, and logwood were also commonly used imported dyes. A most interesting dye is the animal dye cochineal. It is made from the bodies of a beetle which feeds off of a certain cactus.

My hobby of natural dyemaking has been interesting and educational, especially in my work at Spring Mill State Park. If you are interested in seeing one of the actual demonstrations in the Pioneer Village it is best to check beforehand with the Park office to see when they are offered that week.